The Maine Installer

Dedicated to Professionalism in Underground Tank Installation

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Is This Tank Cathodically Protected?

Delbert has had cathodically protected (CP) tanks at his station for 8 years and has yet to have them tested to see if they are, indeed, cathodically protected. Federal law requires that galvanic corrosion protected systems like Delbert's be monitored within 6 months of installation and every 3 years thereafter. Now that the environmental regulatory agency has sent him a letter stating this fact and reminding him that he is in violation of the environmental regulations if his CP tanks haven't been tested, Delbert looks up the name of the guy his installer gave him 8 years ago. Delbert has had enough experience with the flatlanders from the capital to know that this letter is a harbinger of inspectors to come. He also knows that when his tanks were installed, his contractor gave him the low down on how his tanks were protected from corrosion holes. Delbert can see the wisdom of getting a CP tester over to see if everything really checks out.

Charlie, the CP tester, arrives with all the proper paperwork needed to document this blessed event. He brings out his magical meter and hooks one wire to what Delbert knows is his CP test station (a wire connected to the tank) and another wire from the meter to some sort of a probe. He pours water on the soil over the tank ends. He mashes the probe into the ground and peers deep into his meter as if to

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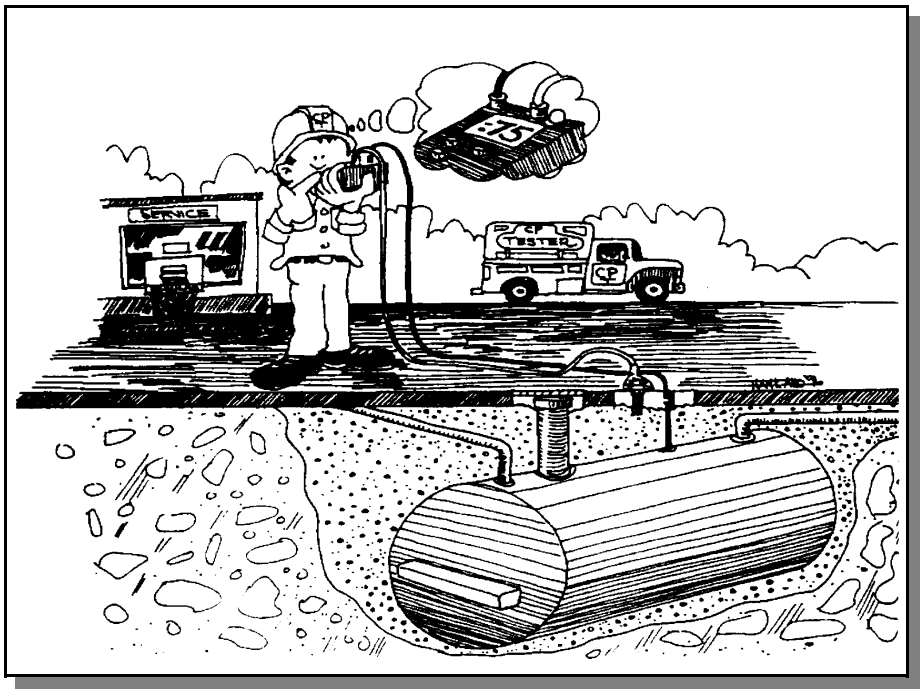

Moving Underground Tanks

During the last few years, Maine has required the removal of underground petroleum storage tanks. There are many tanks that still need to be removed this year. There have been some misinterpretations of the regulations in the transportation of these tanks. The information that a tank can be moved by simply spray painting the number 1203 on the tank is incorrect.

In the ground, they are considered to be bulk petroleum tanks. On the back of a flatbed on the highway, they are still bulk petroleum tanks.No one wants to complicate this process with complex transportation regulations, but safety during transportation can not be ignored. Maine has adopted the federal hazardous material regulations. These regulations provide for a uniform method of communicating hazards during transportation. Every police officer and fire fighter is trained to look for placards, not spray painted numbers.

These tanks do not meet transportation specifications to transport gasoline and are not legally allowed to transport gasoline. While there may be no intent to transport any large quantity of product in these tanks, the tanks still contain enough product to require compliance with the hazardous material regulations. For the purpose of moving these tanks, the regulations are the same for empty bulk tanks as they are for full ones.

⇒ The vehicles transporting the tanks need to be placarded.

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summon the CP spirit of the tank.

But Charlie's characteristic cherubic smile is soon replaced with a look of bedeviled puzzlement. He mashes the probe into other parts of the soil above the tank, as if dowsing for water. He borrows Delbert's dipstick, fastens a bolt with a wire attached to the bottom end, and lowers the apparatus down the fillpipe. He connects the wire from the dipstick to the voltmeter and peers at the meter again. Still not satisfied with the readings he's getting on his meter, he unhooks the lead to the test station and starts touching the vent pipe and some exposed electrical conduit as if to summon their opinion on the situation. But Charlie has performed CP tests often enough to know that he will have to tell Delbert what he surely doesn't want to hear, that his tank is not protected against corrosion.

Since 1986, Maine's rules have required that CP tests be made every year, rather than every three years, as required in the federal rules, either by a certified installer who has been trained by the Maine Department of Environmental Protection or by a cathodic protection tester. Two years ago our office sent out notices to owners of CP tanks to remind them about our annual CP testing requirements. We included sample CP record keeping logs in the mailing. We also sent these notices to our certified tank installers who would be getting the calls to do the work. Once these letters went out, many of the CP installation sins of the past came to light.

The galvanic CP steel tank design relies heavily on isolating the tank from other metallic structures, such as steel piping or electrical conduit which may overwork the CP system. Remember, the CP system was designed to protect only the defects in the tank coating. Isolation is accomplished by providing dielectric bushings (usually made of nylon) at the tank openings. Failure to achieve isolation is the first issue that must be investigated when the CP readings don't meet the specs.

The CP tester in the illustration on page 1 is coming up with a reading of -0.75 volt, which is below the acceptable -0.85-volt level but still well above the naturally occurring reading of a bare steel tank (-0.4 to -0.6 volt). A voltage reading in this range is a positive sign that the cathodic protection system is operating but trying unsuccessfully to protect more than just the tank.

In the past, when a tank installer would call me with questions about a low CP reading, his (or her) first assumption was that the factory anodes had given out and that it was time to slap on a couple of 17 pound magnesium anodes and be done with it. I'd have to tell him that the answer was not necessarily that simple. He'd need to troubleshoot the system to be sure that the tank was, in fact, isolated from all other buried metals. (See Marcel's "How To..." section to find out how this is done.) If the tank is not isolated, then adding anodes will only defer the problem to another not-too-distant time.

Isolating the Problem

We had a rash of reports of low readings soon after our compliance letters went out. It seems that several of our CP testers were running across double-walled CP steel tanks with readings in the -0.6 to -0.7-volt range. The case was cracked when one installer figured out that the leak detection system used to test the interstitial space (the area between the two tank walls) was actually the source of the problem.

Most double-walled steel tanks have an attached 1.5-inch steel monitoring pipe that runs from the bottom of the interstitial space to the surface of the ground. Leak detection probes are placed in the bottom of the pipe where they can detect any leaks. A type of leak detection system popular in Maine uses a probe that senses changes in pressure resulting from changes in the level of the liquid in the bottom of the tube. These pressure changes are communicated to the alarm box by copper tubing that runs from the bottom of the monitoring pipe, up through the top of the monitoring pipe, then underground to the building where the alarm box is located. The copper tubing exits out of the monitoring pipe through an isolating fitting, but if it touches the inside of the monitoring pipe, the copper tubing and everything the tubing touches becomes, inadvertently, part of the tank's cathodic protection system.

When everything is electrically connected in this way, the anodes on

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Moving Underground Tanks

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⇒ The driver must have shipping papers properly describing the remaining product (residue) in the tank.

⇒ Because placards are required, vehicles and drivers must comply with the federal motor carrier regulations and CDL endorsements.

If you have any further questions about the regulations or transportation requirements you can contact: Maine State Police, Commercial Vehicle Division, 242 State Street, Station #20, Augusta, ME 04333-0020 -- (207) 287-1057, (207) 287-6248 FAX

Jim Wright, Maine State Police.

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the tank are trying valiantly to protect not only the tank but also the buried copper tubing and any other buried metal structures --plumbing, rebar in the concrete foundation, buried electrical conduit (you get the picture) -- caught up in this vast electrical web. This problem is easily fixed by sleeving the copper tubing in small diameter PVC pipe so it doesn't touch the sidewalls of the monitoring pipe. Once this was done, our CP testers found that their readings quickly came up to spec. Needless to say, after that discovery I was a hero many times over. I simply disseminated my acquired wisdom when the subject of low readings on double-walled steel tanks was brought up, saving the contractor the agony of further troubleshooting.

Of course, lack of isolation is not the only possible cause of low readings, but it is the most common one. Very dry soils and spent anodes are also possible causes.

More is Not Better

Several years ago, a large heating oil jobber in our state tested the CP tanks of an industrial client. At this site, the jobber was getting readings that were too high. Now, where cathodic protection is concerned, more is not always better; the readings this tester was getting on these tanks were in the -2.0 + range and fluctuating. But such readings are no mystery to a corrosion expert when he knows that the industrial client is in the business of welding together steel beams.

When a piece of metal is electrically welded, a current must pass from a grounded welding machine, through the welding rod, to the metal, which is also grounded so the current can flow back through the earth, thus completing the circuit. But some of the current sometimes goes astray through the ground, striking other objects, like buried tanks. So the high readings that our CP tester encountered here were not from the tank's anodes but from the welding machine.

According to a corrosion engineer, the fix to this particular problem is to install a plastic vertical liner between the welding machine system and the

tank to block the stray currents from affecting the tank. Of course, a better solution is to not install a CP tank in this kind of environment in the first place -- a fiberglass, composite, or jacketed-steel tank is more appropriate. According to the installer, the client was given the fiberglass tank option; however, the low price of the CP tank and the client's affinity for things made of steel won the day. So, before buying a CP tank, check for possible sources of stray currents. If it's too late, then call a corrosion expert. (Contact NACE at (281) 492-0535 ext. 214 for a list of qualified corrosion professionals in your area.)

Other sources of stray currents include electric bus or subway systems, communication towers, or even adjacent impressed current cathodic protection systems protecting buried gas mains or other USTS.

Disappearing Anodes

During the first season of our cathodic protection compliance campaign, a coastal sewer district had the CP tested on an emergency generator tank at one of its coastal lift stations in close proximity to a salt marsh. The reading came in around -1.1 volts that year, but the next year, when the sewer district attempted to start the generator up for its own annual testing, it got a good dose of salty ground water rather than its normal diet of diesel fuel. The tank was removed, and a couple of good-sized holes were found near the bottom. There was no sign of the anodes.

Several things could have gone awry here. First, the CP tank had been installed in a very aggressive environment. The ground water in this area was affected by the ocean; it had a high salt content and would fluctuate with the tide. This made the electrolyte of our corrosion cell very conductive, meaning that the CP system would

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Annual Maintenance for ATG's

MeDEP has Annual ATG Maintenance log sheets available for those tank owners who use an Automatic Tank Gauge for leak detection on their underground tank. If you are using an ATG for leak detection then it needs to be checked annually for proper operation. This log sheet includes a check-off list of the items that need to be inspected annually. It also includes instructions for checking the ATG probe to make sure it is operating properly.

Copies will be mailed to all tank installers when the annual tank maintenance checklist is mailed to tank owners in late April. The mailing to tank owners will **not** include these log sheets.

If you would like extra copies of this log sheet please call Beth DeHaas or any of the "Tanks" staff at 207-287-2651.

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work very effectively but also that the anodes would be used up faster. Again, a corrosion-protected fiberglass, composite, or jacketed-steel tank would have been a more corrosion-resistant solution in this location. Second, it is possible that the anode used in this early design was magnesium, which is not suited for saltwater environments. For this reason, zinc anodes are used on ship bottoms to fight the effects of saltwater corrosion.

There is still the disturbing question of why the tank had a passing reading one year and holes the next. There was no evidence of the anodes during the excavation, but then again, we're not talking about an archeological dig here either, so who knows if anything was left of them or not. I say "disturbing" because this means that a) the anodes were not protecting the whole tank, b) the anodes quit working and the holes were formed in less than a year, or c) the CP readings from the prior year were incorrect. Based on the contractor's prior experience in CP troubleshooting, I believe the initial readings were indeed correct. I might also add that the tank in this story was not a sti-P3 tank, which is the industry standard for preengineered cathodically protected tanks.

Time And Testing Will Tell

As you can see from my smattering of stories, there are a lot things to consider when installing and testing cathodically protected UST systems. There are some sites in this state where installers have completed all troubleshooting and still can't get good readings on tanks less than 10 years old in relatively noncorrosive backfill. Jacketed tanks with a steel inner shells and polyeythelene or fiberglass outer shells that provide corrosion protection for the inner steel tank have become popular in Maine at the expense of CP steel.

Cathodic protection has had a long and successful track record in the protection of such steel structures as ship bottoms, cross-country buried pipelines, buried and submerged bridge supports, and oil terminal tank bottoms. Most of these CP systems have site-specific designs and are for the most part tested and maintained by corrosion technicians.

Most cathodically protected USTs are sold as preengineered packages, based on the assumption that one size fits all. These systems have been around since 1969, but until about 10 years ago, they were not installed in very large numbers. As this population of tanks ages, it will become increasingly important to monitor the effectiveness of their corrosion protection to avoid repeating the corrosion problems of the past.

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by David McCaskill, Environmental Specialist, Maine Department of Environmental Protection. Reprinted from LUSTLine, Bulletin 25. New England Interstate Water Pollution Control Commission, Wilmington, MA.

It's Spring and It's CP Testing Time

Spring is here, or at least on its way! The MDEP Underground Tanks Enforcement Unit wants to remind you that it is again the annual cathodic protection testing season. The annual mailing of the cathodic protection letter and logsheet to the owners of these tanks, as well as the letters and logsheets to you, the installers, will be on its way in the mail by mid April. Please look over the letter and logsheet carefully. We've made a few changes, including a reminder that any time a cathodically protected system is repaired, the cathodically protected tank system must be tested again 6-12 weeks after the repair, to ensure that it is working correctly. We kept the trouble shooting list on the back of the logsheet, and would welcome any suggestions from you to improve that list. Again, we welcome any comments or suggestions regarding this mailing, and we will try our best to answer your questions (or track down someone who can). If you need to reach us, call 207-287-2651, and ask to speak to someone from the Underground Tanks Enforcement Unit.

Testing Cathodic Protection Systems

Leak Prevention Tank-nically Speaking

As David pointed out in the first part of this article, testing of cathodically protected structures is not always straight forward and does not always have the desired outcome. I had similar experiences this fall while teaching corrosion/cathodic protection courses across the country. It is clear to me that testing cathodically protected structures is rarely a " cookbook " type of procedure. A clear understanding of cathodic protection principles is a prerequisite for the correct execution of the monitoring procedure and reasonable interpretation of the monitoring results.

Having said that, I hereby offer my recipe for monitoring the status of a cathodically protected UST system. My goal is not to turn any casual reader into a cathodic protection tester but to provide some guidance for those who need a refresher. An understanding of how the monitoring procedure should be carried out may also help regulators and storage system owners understand what's what when they are reviewing cathodic protection monitoring reports.

As always, comments on how this recipe can be improved are welcome.

Equipment Needed:

⇒ A voltmeter with at least 10 megohm (million ohms) input impedance. Most voltmeters with a digital display will meet this requirement. Although a model from a consumer electronics store will give accurate readings, a voltmeter specifically intended for cathodic protection monitoring will likely be more durable in the field environment.

⇒ A copper/copper sulfate reference electrode (also known as *a* "half-cell" or "reference cell"). Typical reference electrodes are about 1 inch in diameter and 6 inches in length. They may have either a flat *or a* cone-shaped, porous ceramic tip at one end that is covered with a plastic cap. The cap must be removed when cathodic protection measurements are conducted, but it should be kept in place on the reference electrode whenever it is not in use to minimize evaporation of the copper sulfate solution inside the electrode.

Maintain the reference electrode as follows:

- Keep the reference electrode about 3/4 full with distilled water.
- Be sure that undissolved copper sulfate crystals are always visible inside the reference electrode.
- Discard the solution inside the reference cell when it becomes cloudy. Refill the reference cell with copper sulfate crystals and distilled water. Clean the copper rod with nonmetallic sandpaper.
- Keep the reference cell away from freezing temperatures so that the copper sulfate solution does not freeze, or use the copper sulfate anti-freeze solution provided by the half cell manufacturer.

⇒ Two test leads (plastic coated wires with fittings on the end) that plug into the voltmeter and can be clipped onto the reference cell and the structure being monitored. Test leads can be any length; however, 2- to 3-foot lengths are typical. It is also a good idea to have a 20- to 30-foot length of wire handy, in addition to the two test leads for field work.

⇒ A standardized form that can be used to record pertinent information concerning the facility, sketch the facility, note voltage

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If you have any questions of a technical or regulatory nature that you wish to have answered in this newsletter, please direct them to Jim Hynson, Board of Underground Storage Tank Installers, c/o Maine Department of Environmental Protection, State House Station 17, Augusta, ME 04333. Or call 207/287-7889. Or E Mail Jim.R.Hynson@state.me.us

Testing Cathodic Protection Systems

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readings, and indicate the locations where voltage measurements were made.

Testing Procedure:

Determine how you will obtain an electrical connection with the structure that is to be monitored. If you are

1 monitoring an sti-P3 tank, there may be a monitoring wire (usually green in color) coming up out of the ground and attached to the submersible pump riser, the automatic tank gauge riser, or the fill pipe riser ("riser" is a generic term for a vertical pipe attached to the top of an underground tank), or located in a special cathodic protection test station. If no wire can be found, see the "What If ... ?" section that follows.

Determine where you will place the reference cell. The reference cell must be in contact with clean, moist soil, not

2 with concrete or asphalt. See the "What If ... ?" section that follows if no clean soil is accessible. The ideal location is along the top middle of the tank. On many tanks installed after 1990 or so, this is where the automatic tank gauge riser is located and where soil is usually accessible. Other possible locations are around the submersible pump or, if a spill containment manhole has not yet been installed, around the fill pipe.

The purpose of monitoring is to ensure that the entire tank is protected. This means that the portion of the tank farthest away from the anodes must still meet the criteria for protection. Sti-P3 tanks of 10,000 gallons and less have anodes located on the ends; this means that the reference electrode should be placed at the top middle of the tank. Readings taken with the reference electrode placed near the ends of the tank will be higher. If there is no access to soil over the top of the tank, see the "What if ... ?" section that follows.

It is good practice to take voltage readings with the reference electrode in as many locations as practicable. I have seen tanks where one end of the tank registered 0.95 volts, the middle registered 0.88 volts, and the other end registered 0.83 volts. This situation could result from an actual deficiency in the cathodic protection caused by significant coating damage at on end of the tank or failure to unwrap the anode at one end of the tank. This deficiency could not have been discovered if only a single reading had been made at the middle of the tank. Note, however, that this situation could also result from petroleum contamination in the soil where the reference cell is placed (e.g., around the fill pipe) or from something that acts to shield the reference cell from the tank (e.g., a metal culvert around the submersible pump).

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Unless the soil where you intend to place the reference electrode is quite wet, you will need to add moisture.

3 Pour a quart to a gallon of water on the location where the electrode is to be placed and allow the water to be absorbed into the soil before taking the reading.

Turn on the voltmeter and watch the display to be sure that it is behaving normally. Consult the meter's

4 instructions if you don't know what it is supposed to read when you first turn it on. If your instrument has multiple functions, be sure that it is set to make low voltage DC measurements and that the test leads are plugged into the

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Board Bio: Robert H. Judkins

Bob came to the Board as the representative of the Maine Oil and Solid Fuel Board in May, 1994. He is the public member of the Oil and Solid Fuel Board and resides in Augusta and Winthrop. He has three children and seven grandchildren and is 65 years old.

Bob is a graduate of Cony High School in Augusta and a veteran of the Korean War, where he served in the Air Force between 1951 and 1952 as an expert in fire and crash rescue. Once he returned from Korea he served on the Augusta Fire Department between 1953 and 1969 and was its chief between 1966 and 1969. From there he went to the State Fire Marshal's Office where he was an inspector and investigator between 1969 and 1971. He became the Supervisor of Inspection in 1971 and served in that capacity until October 1, 1991 when he retired from state service.

As evidence that you can't keep a good man down, though, he went back to work in the private sector after he retired. In April, 1994, he took a job as a Section (8) housing inspector for Dirigo Housing/Property Management.

In his spare time, Bob enjoys fishing, hunting, and traveling.

Testing Cathodic Protection Systems

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correct sockets. Connect the positive lead of the voltmeter to the wire from the structure to be monitored and the negative lead from the voltmeter to the terminal at the top of the reference electrode. Do not touch any metal portions of the test leads when making a reading.

The display on the meter should be steady. Fluctuations of 0.01 volt are okay, but fluctuations greater than this may indicate a bad connection. There should be a negative sign in front of the reading, and the reading should be more negative (greater) than -0.85 volts (which is the same as -850 millivolts). Don't let the negative sign confuse you (-0.90 volts is greater than -0.85 volts [this is what you want]; -0.80 volts is less than -0.85 volts [this is what you don't want]). The table below, "Interpreting What Your Voltmeter Is Telling You" should help you interpret your readings.

No job is done until the paperwork is completed. While you should document the cathodic protection monitoring with the usual site information (e.g., facility name, address), you should also make a quick sketch of the layout of the facility and indicate the reference electrode location(s) and the corresponding voltage readings.

Interpreting what Your Voltmeter is Telling You

READING	WHAT READING INDICATES
Greater than -1.65 volts for a structure with magnesium anodes	The maximum voltage output from a magnesium anode is -1.65 volts. If your reading is greater than this, the system could have impressed current cathodic protection rather than galvanic, or there could be stray currents in the vicinity. It it turns out this is NOT an impressed current system, have a corrosion engineer investigate as soon as possible.
Greater than -1.1 volts for a structure with zinc anodes	The maximum voltage output from a zinc anode is -1.1 volts. If your reading is greater than this, the system could have impressed current cathodic protection rather than galvanic, or there could be stray currents in the vicinity. If it turns out this is NOT an impressed current system, have a corrosion engineer investigate as soon as possible.
Greater than -0.88 volt	Structure is adequately protected.
-0.85 volt to -0.88 volt	Structure still meets the standard for corrosion protection, but there is not much of a safety cushion. Monitor the system closely to determine the rate at which the voltage is dropping and plan on adding anodes or performing other work on the system in the not too distant future.
Less than -0.85 volt	The structure does not meet the -0.85-volt standard for corrosion protection and is out of compliance with regulatory requirements. This does not mean, however, that the tank is leaking. (See "What if the tank or piping does not meet the -0.85 criterion?" in the following section.)
-0.4 volt to -0.6 volt	Expect this voltage range from steel that has no cathodic protection. This could indicate that the tank was not cathodically protected originally, or that the anodes are completely shot. Call in a corrosion engineer to investigate.
-0.3 volt to -0.4 volt	Rusty steel will sometimes register down in this range. Call in a corrosion engineer to investigate.
-0.1 volt to 0.0 volt	This type of reading is most likely to occur if you are measuring the potential of a piece of copper. Most likely the copper wire you are connected to is broken off underground. Find another way to get an electrical connection to the structure you want to monitor.
Variable readings	This could indicate stray currents, but check your meter to be sure that it is operating properly and that all test lead connections are in solid contact with shiny metal.
Wildly fluctuating readings (digital meter)	This probably indicates that one of your test lead connections is not good or that your reference cell is dry. Make sure that all your connections are solid metal to metal. Might also be indicative of extremely dry conditions in the backfill. Run water from a garden hose into the tank backfill for a couple of hours and take another reading.

Testing Cathodic Protection Systems

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Duplicating the reference cell locations over time is key to obtaining meaningful cathodic protection data.

What If...?

What if there is no monitoring wire for the tank?
You need an electrical contact with the tank. If the tank is an sti-P3 tank, all of the risers attached to the top of the tank are electrically isolated from the tank shell and cannot be used to obtain readings of the tank itself. To obtain a reading in this situation, make contact with the bottom of the tank through the fill pipe.

A "quick and dirty" way to do this is to fasten a length of wire (20 feet long or so) to a brass bolt and then fasten the bolt with a stainless steel hose clamp to the end of a dip stick so that the head of the bolt extends slightly beyond the end of the stick. Clip the end of the wire that is not attached to the bolt to the positive test lead from the voltmeter.

Insert the bolt end of the stick into the fill pipe and press firmly against the bottom of the tank. There may be sludge and scale on the tank bottom which will require firm pressure and a little twisting motion on the stick to obtain good electrical contact. Good contact is indicated by a steady reading on the digital display of the voltmeter.

Be aware, some drop tubes are equipped with tank bottom protectors to prevent any damage that might occur when the dipstick repeatedly strikes the bottom of the tank. The tank bottom protector consists of a metallic plate that is attached to the bottom of the drop tube. A neoprene disc separates the bottom protector and the bottom of the tank, electrically isolating the tank bottom from the tank bottom protector.

Because the tank bottom protector is connected to the drop tube and the drop tube is connected to the fill pipe, the voltage reading obtained through the fill pipe will reflect the voltage of the fill pipe relative to the reference electrode, rather than the tank voltage. So if the dipstick method results in a reading in the unprotected range (0.4 to 0.6 volts) take a reading on the fill pipe. If the fill pipe reading and the dipstick reading are identical and a drop tube is present, remove the drop tube and check for a tank bottom protector before concluding that the tank is not adequately protected.

In some cases, if the tank is equipped with a manway at the bottom of a containment sump, it may be possible to contact the tank shell directly. Look carefully around the manway to determine how electrical isolation is being accomplished and whether any metal connected to the tank shell, or the tank shell itself, is accessible.

What if tank is equipped with a PP4 monitoring station?

If the tank is an sti-P3 tank installed around 1993 or later, it may have a test station consisting of a plastic dome about 3 inches in diameter with five metal terminals imbedded in it that are flush with the surface of the dome. The central terminal connects to a permanently buried reference cell (you don't need your copper/copper sulfate reference electrode to test this tank), and the four terminals around the center connect to one or more tanks. Simply connect the negative voltmeter lead to the center terminal and the other lead to each of the other terminals on the test station. You should get appropriate readings on as many terminals as there are tanks buried at the facility.

What if I need to monitor piping?

Cathodically protected piping is rarely equipped with monitoring wires to facilitate cathodic protection monitoring, but this is not a serious omission in most cases. Usually, the piping will be accessible at both the top of the tank and beneath the dispenser. There is typically also soil exposed at these locations for placing the reference electrode. If the anodes have been installed as suggested in the Petroleum Equipment Institute's "Recommended Practices for Installation of Underground Liquid Storage Systems" (PEI RPI00), the ends of the piping will be the points in the system the furthest away from the anodes and are good places to locate the reference

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Hot Info For Sale

The Maine Department of Environmental Protection now has the following lists available for sale to the public.

The Whole Tank List - A list of all the registered tanks in Maine. Includes all the data from our data base including facility information, owner operator information and tank descriptions. Available on disc (Four 3 1/2X5 inch discs - you provide) or paper list.

Town list - A list of all the underground tanks in a town. List includes facility name, owners information, tank material, date installed, product stored, size, leak detection and current status. Sorted alphabetically by owner's name. Size (and price) of list varies.

Tanks past due for removal - Two reports available. One prints labels (20 pages) with owners name and address sorted alphabetically by owner's town. One is a paper list (202 pages) including owner info., facility info. and tank info. This is sorted alphabetically by town and then facility name.

Tanks due out by 1997/98 - Two reports available. One prints labels (44

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electrode. Be sure that the point of contact between the piping and the voltmeter test lead is clean shiny metal to ensure a good reading.

What if there is no soil along the tank top in which to place the reference electrode?

It is possible to get voltage readings by placing the reference electrode on damp concrete or asphalt, but these readings are generally not considered to be accurate or reliable. In my experience, readings taken with the reference electrode on concrete will always yield a reading in the range of -1 volt, regardless of whether the tank is cathodically protected. Readings through asphalt are unreliable because the voltage is determined by the location of cracks in the asphalt and not the actual placement of the reference cell. The reference electrode can be placed some distance away at the nearest available soil, but again, this is not the most accurate measure of the corrosion protection status of the tank. In my view, the solution is to drill a hole through the concrete or asphalt to allow direct contact between the reference cell and the soil in close proximity to the tank top.

What if the soil is -"dry-?

I often hear that storage systems fail to meet cathodic protection criteria because the tank environment is too dry. While this may occasionally be true in parts of the desert southwest, it is not a likely occurrence in most other parts of the United States. If excessively dry conditions are suspected, run a garden hose to the tank top and pour a large amount of water into the tank backfill.

What if the soil where I need to place my reference electrode is contaminated with petroleum?

Don't take a reading in soil that is saturated with petroleum. Petroleum is not an electrolyte; the reference electrode must contact an electrolyte (e. g., water) for the reading to be accurate. A slight petroleum odor is acceptable for cathodic monitoring purposes, but soil saturated with petroleum will seriously affect readings.

What if the soil is frozen?

Traditional wisdom indicates that cathodic protection monitoring cannot be conducted in frozen soils because ice is not an electrolyte. Experience in Maine indicates, however, that monitoring can be successfully conducted in frozen soils if water is used to dampen the soil where the reference electrode is placed.

What if the tank or piping does not meet the -0.85 criterion?

The most common reason for failure to meet the -0.85 criterion for galvanic cathodic protection is failure to electrically isolate the cathodically protected structure from other buried metallic or electrical components. The best method for identifying such components is to measure the voltage of all accessible metal (e.g., piping, electrical conduit, utility piping, leak detection probes). This is done by measuring the tank voltage as described in steps 1 through 5 above and then connecting the negative lead of the voltmeter to all accessible metallic structures *without moving the reference cell.* (This is where that 20- to 30-foot length of wire from the "equipment needed" section comes in handy.) A reading of within a few millivolts of the tank reading indicates that the two structures are electrically connected. The exact place where the two structures are in contact must be located and the connection broken for the cathodic protection to work.

Inadequately isolated tank anchoring hardware, although a likely source of electrical isolation problems, usually cannot be evaluated using this technique, because the voltmeter connection cannot be made unless the top of the tank is excavated.

Another possible reason for failure to achieve -0.85 volt is excessively dry soil. Refer to the "What if the soil is dry?" section above.

If the tank is isolated and the backfill is damp, but -0.85-volt reading still cannot be measured, research the installation procedures to see if you can discover any clues. Then call the Steel Tank Institute, the tank manufacturer,

(Continued on page 10)

Hot Info For Sale

(Continued from page 8)
pages) with owners name and address sorted alphabetically by owner's town. One is a paper list (325 pages) including owner info., facility info. and tank info. This is sorted alphabetically by town and then facility name.

Cathodically protected tanks - Two reports available. One prints labels with owner's name and address. One is a paper list (205 pages) including owner info., facility info. and tank info sorted by facility town then facility name.

Prices are based on the number of pages in the report. Paper lists 1-10 pages in length are $10; 11-100 pages are$25; 101-250 pages are $50 and 250+ pages are $100. Prices for labels were not available at press time. If you are interested in receiving an order form and a copy of the first page from each of the paper lists send your name, address and telephone number to Maine Department of Environmental Protection, #17 Station, Augusta, ME 04333 ATTN: TANKS LIST. Prepayment required. Sorry, no custom lists.

Testing Cathodic Protection Systems

(Continued from page 9)
or a corrosion engineer for help.

Testing Impressed Current Cathodic Protection Systems

Equipment Needed:

The equipment list for monitoring impressed current cathodic protection systems is the same as for galvanic systems.

Testing Procedure:

Making an electrical connection to a structure with impressed current cathodic protection is relatively easy; none of the components should be electrically isolated from one another. The fill pipe or any other accessible tank riser is usually a good place to make a connection to the tank.

1 One case where this may not be true is when impressed current cathodic protection has been added to a sti-P3 tank. In this case, use the continuity test described under the galvanic cathodic protection question "What if the tank or piping does not meet the -0.85-volt criterion?" to check to be sure that all metallic components of the system are continuous. Use the dipstick method described under the question "What if there is no monitoring wire for the tank?" to check the voltage of the tank shell.

The guidelines for placement of the reference cell are basically the same as for galvanic systems. The reference cell should be close to the structure being monitored and as far away from the anode locations as possible. Anode locations can often be inferred from saw cuts and small areas of patched asphalt or concrete. Anode locations

2 should also be indicated on the cathodic protection design documents.

The soil where the reference electrode is placed should be wet as for galvanic systems.

Test lead connections and voltmeter settings are also the same for impressed current systems as for galvanic systems.

The 0.85-volt criterion most commonly utilized for galvanic cathodic protection

3 systems can be applied to impressed current systems but is not considered the most effective for these systems. There are many differing

4 opinions among corrosion engineers as to the best technique for monitoring the effectiveness of impressed current

5 systems. The 100 millivolt (0.1 volt) polarization decay criterion that is described here is included in the National Association of Corrosion Engineers' RP-0285-95.

The set-up of the monitoring equipment (reference electrode, voltmeter, and test leads) is the same as for galvanic monitoring. What is monitored, however, is the change in voltage of the structure that occurs after the power to the rectifier is shut-off. This procedure requires two people to execute it properly: one person to switch off the rectifier, and the other to monitor the change in voltage of the underground storage system.

When the power to the rectifier is interrupted, there will be an immediate drop in the voltage reading at the tank, followed by a continuing slow decline in the voltage. The person monitoring the voltmeter must note the voltage reading immediately after the power to the rectifier is interrupted. (If the meter is digital, the numbers will change rapidly. The reading you want is the second number that appears on the meter's display.) The voltage is then monitored for several minutes (possibly much longer in stubborn cases) with the rectifier turned off. The criterion for cathodic protection is a voltage shift of at least 0.10 volt from the initial reading after the power to the rectifier is cut off. For example, a system might have a voltage of -1.1 volts with the power to the rectifier turned on. Immediately after shutting off the power to the rectifier, the voltage might drop to -0.83 volt. The voltage must then drop below -0.73 volt (0.83 - 0.10 = 0.73) to meet the criterion for effective cathodic protection.

Another way to determine if this criterion for cathodic protection has been met depends on whether the original voltage of the tank (i.e., before any cathodic protection was applied) is known. If the voltage reading immediately after the rectifier is turned off is at least 100 millivolts more negative than the original unprotected voltage, then the 100 millivolt criterion has been met

Do not forget to restore power to the rectifier before you leave the site!

By Marcel Moreau.. Reprinted from LUSTLine, Bulletin 25. New England Interstate Water Pollution Control Commission, Wilmington, MA.

DATE: APRIL 1997

TO: **MAINE CERTIFIED UNDERGROUND TANK INSTALLERS**

FROM: BUREAU OF REMEDIATION & WASTE MANAGEMENT
DIVISION OF OIL & HAZARDOUS WASTE FACILITIES REGULATION

RE: YEARLY CATHODIC PROTECTION SYSTEM TEST RESULTS

****

To All Maine Certified Tank Installers:

The Department will again this year, be sending letters to owners of underground oil storage facilities which are listed as cathodically protected, notifying them to have their systems tested. A copy of the letter along with its corresponding logsheet is enclosed.

The Department recognizes that cathodic protection system testing will be performed by CTIs and request that if the test results show that the system is not working properly, **call the Department before any repair work is performed. (Tel. #207-287-2651, 8am-5pm, Mon-Fri).** When you call, please describe the repair work being planned, and indicate which tanks are being worked on.

After the repair (or anode replacement) is done, the Department requests that you send Bill Walentine of our Licensing Division, a brief description of the work you did (and please include the underground oil storage facility registration number). All correspondence can be sent it to the following address:

Department of Environmental Protection
Bureau of Remediation & Waste Management
Division of Oil & Hazardous Waste Facilities Regulation
ATTN: William Walentine
#17 State House Station
Augusta, Maine 04333-0017

Please be reminded that State regulations also require that "within six (6) to twelve (12) weeks of a repair to a cathodic protection system, the owner or operator must have the system tested by a cathodic protection tester in accordance with Appendix A." (Chapter 691.5(D)(17)(h))

If you've checked out all the possibilities for poor readings (including using the trouble shooting checklist on the back of the cathodic protection logsheet) and need more guidance before deciding what repairs need to be done, further technical help can be obtained from:

Taylor Leon, Steel Tank Institute: 1-800-275-1300 or FAX: 708-438-8766

Thank-you in advance for your cooperation on this matter.
The Underground Oil Storage Facility Enforcement Unit

cpinst97

NOTICE

DATE: APRIL 1997
TO: OWNERS OF CATHODICALLY PROTECTED UNDERGROUND OIL STORAGE FACILITIES
FROM: DIVISION OF OIL & HAZARDOUS WASTE FACILITIES REGULATION BUREAU OF REMEDIATION & WASTE MANAGEMENT
RE: YEARLY TESTING OF CATHODIC CORROSION PROTECTION SYSTEMS

****

Dear Facility Owner:

Department records show that you own a cathodically protected underground oil storage facility or facilities. Department regulations require that all owners and operators of cathodically protected underground oil storage facilities *have their system tested once a year* to ensure that it is still working to protect the tanks/piping from rusting. This testing and maintenance procedure is important because if the cathodic protection system stops working, the tank and piping will corrode, and may have to be replaced earlier than you have planned.

This test must be done by a Maine Certified Underground Tank Installer or a cathodic protection tester certified by the National Association of Corrosion Engineers (NACE) in accordance with Department Regulations, Chapter 691, Appendices M and N. According to Department Regulations:

> **All galvanic cathodic protection systems shall be operated and maintained to continuously provide adequate corrosion protection to the metal components of the facility routinely storing or containing oil, and in a manner that ensures that no leaks occur during the operational life of the facility. Adequate corrosion protection is indicated by a cathodic protection test reading of at least negative 0.85 volts.** (Note: These readings cannot be obtained in frozen or dry soil). **Steel composite tanks without secondary containment and continuous interstitial space monitoring shall comply with this requirement.**
>
> **All cathodically protected tanks and piping shall have an accurate structure to soil potential reading performed by a qualified cathodic protection tester upon installation or repair and annually thereafter** Chapter 691.5(D)(4)**.**

The Department recommends that you schedule the testing of your facility(ies) during rainy seasons (usually spring and mid autumn) in order to ensure the best voltage readings from the cathodic system. Cathodic testing results from dry or frozen soil may falsely indicate that the system is no longer working correctly, and cause you to spend time and/or money tracking down the cause of a nonexistent problem.

(Please note that in a few weeks, the Department will be mailing out logs sheets for the 'Annual Tank System Inspection' also required by regulation. You may be able to save money by having both your annual cathodic protection system check and your annual tank system inspection completed at the same time).

If your facility inspection reveals that your tanks are equipped with a cathodic protection system but the underground piping is constructed of galvanized steel or any other non protected metal, the piping will need to be replaced. The last removal deadline for non-conforming piping is October 1, 1997. Some facilities may be subject to an earlier removal deadline, based on the age and location of the facility.

The Department requests that you notify us before any repair work to the underground piping or tank cathodic protection system is performed. Also, any repair work performed on galvanic cathodic protection systems MUST be performed by a Maine Certified Tank Installer. Should you need to have such work performed, please contact the Department for a list of certified tank installers. Work on impressed current cathodic protection systems must be supervised by a Corrosion Expert*.

* "Corrosion Expert" means a person who is certified by the Commissioner and is accredited as being qualified by NACE (National Association of Corrosion Engineers) or, is a professional engineer registered in this State who has certification or licensing that includes education and experience in corrosion control of buried or submerged metal tanks or piping.

After the cathodic protection system has been repaired, it must be re-tested 6 -12 weeks after the repair by a cathodic protection tester to ensure that it is continuing to work correctly.

> **Within six (6) to twelve (12) weeks of a repair to a cathodic protection system, the owner or operator must have the system tested by a cathodic protection tester in accordance with Appendix A.** (of Chapter 691 Regulations)
> Chapter 691.5(D)(17)(h)

A written record of all tests and repairs to the cathodic protection system must be kept in a logbook at the site. The log must include the date, results, and the name of the individual conducting the annual tests, and be available for review by DEP personnel during inspections. A **log sheet** is enclosed for your use. This year we are again suggesting that a copy of the cathodic test results be sent to the Department at the address listed at the end of this Notice. This will ensure that a copy of the latest test results will be placed in your registration file and recorded as having been performed in 1997.

Failure to test your cathodic corrosion protection system yearly and to keep the necessary records in a logbook at the site as proof of compliance, is a violation of state regulations. Failure to comply with these regulations could result in an increased deductible of $5,000.00 under the Groundwater Oil Clean-Up Fund, should you need to access the fund. It is both an environmental and financial benefit to keep your cathodic protection system tested to ensure that it is operating properly.

Should you have any questions about this notice, call the Department at 207-287-2651 and ask to speak to the Oil Enforcement Unit. Please have your **facility registration number** (printed on the same page of the tank(s) list) ready when you call. Thank you for your cooperation on this important matter.

The Division of Oil & Hazardous Waste Facilities Regulation
Bureau of Remediation & Waste Management
Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Hazardous Materials & Solid Waste Control
#17 State House Station
Augusta, Maine 04333-0017

CATHODIC PROTECTION LOGSHEET

UNDERGROUND OIL FACILITY REGISTRATION NUMBER _____
FACILITY NAME:_____
LOCATION:_____

(THIS CATHODIC PROTECTION SYSTEM MUST BE TESTED YEARLY)

TANK SIZE	PRODUCT	TANK READINGS	PRODUCT PIPE READINGS	VENT PIPE READINGS

TESTER'S NAME(PRINT) **TESTER'S SIGNATURE** **DATE** **INSTALLER #**

REMINDERS

1. TO FIND SOMEONE TO TEST YOUR CATHODIC PROTECTION SYSTEM CHECK WITH:
   THE INSTALLER WHO PUT THE TANK(S) AND PIPING IN,
   YOUR OIL/MOTOR FUEL SUPPLIER,
   THE PHONE BOOK YELLOW PAGES UNDER **TANKS**; OR,
   CALL THE DEPARTMENT AT 207-287-2651 FOR A LIST OF CERTIFIED TANK INSTALLERS

2. ALWAYS SCHEDULE THE TESTING DURING THE RAINY SEASONS WHEN THE SOIL IS **NOT** FROZEN.

3. YOUR TEST RESULTS SHOULD BE AT LEAST -0.85 VOLTS,(i.e. -0.86, -0.89, -0.91, ETC.). IF THE TEST WAS DONE IN DRY SOIL CONDITIONS AND FAILED, SCHEDULE ANOTHER TEST DURING THE NEXT RAINY SEASON.

4. PLEASE SEND A COPY OF THE LOGSHEET TO THE DEPARTMENT AT THE ADDRESS LISTED ABOVE.

5. THE DEPARTMENT REQUESTS THAT YOU NOTIFY US BEFORE HAVING YOUR CATHODIC PROTECTION SYSTEM REPAIRED OR REPLACED. ALL REPAIR WORK ON GALVANIC CATHODICALLY PROTECTED UNDERGROUND TANKS AND PIPING MUST BE DONE BY A MAINE LICENSED UNDERGROUND TANK INSTALLER. WORK ON IMPRESSED CURRENT SYSTEMS MUST BE SUPERVISED BY A CORROSION EXPERT.

6. STATE REGULATIONS ALSO REQUIRE THAT A CATHODIC PROTECTION SYSTEM THAT HAS BEEN REPAIRED BE CHECKED 6-12 WEEKS AFTER THE REPAIR TO ENSURE THAT IT IS WORKING CORRECTLY. (Chapter 691.5(D)(17).

QUESTIONS?? CALL US AT: **(207) 287-2651** THE OIL ENFORCEMENT UNIT

Training Update

February 27 marked the now annual tank installer seminar held by the Maine Oil Dealers' Association (MODA) in cooperation with the Maine Department of Environmental Protection (DEP). This year was a special success in that it concentrated on line leak detectors and automatic tank guages (ATG), their installation, operation, and maintenance. The morning included both general descriptions of how this technology operates as well as specific information from three manufacturers. By all accounts, this proved to be a very informative program.

The afternoon consisted of DEP staff updating tank installers on changes to the underground tank and vapor recovery rules. If you missed this program, you missed an informative session.

If, however, you missed receiving a notice of this program, you should contact staff to the BUSTI Board as soon as possible. We need to make sure our records are accurate on your whereabouts.

Meanwhile, a number of private firms continue to offer safety training that has been accredited by the Board of Underground Storage Tank Installers. This is a real bargain, since not only can you meet your educational requirements for the U.S. Occupational Safety and Health Agency (OSHA), you can get tank installer credit as well. Most one day refreshers receive two (2) credit hours for tank installer training, and the major 40 hour courses allow installers who have not previously taken a 40 hour course to receive all eight (8) credits needed for biennial recertification.

The firms approved for BUSTI credit are:

⇒ Burgess & Associations (credit expires 4/97), PO Box 129, Plymouth, ME 04969, Toll Free in State 800/773-2723, Out of State 207/257-2723, FAX 207/257-2040;

⇒ Safetech (credit expires 6/97), 800 Southborough Drive, South Portland, ME 04106, 207/773-5753, FAX 207/773-7044;

⇒ Field Services, Inc. (credit expires 10/97), 995 Forest Avenue, Portland, ME 04103, 207/878-9070; and

⇒ Safety Communications (credit expires 1/98), 117 Allen Rd., Presque Isle, ME 207/762-3481.

Board credit lasts for a period of one year after last issued. As a general rule, these vendors have routinely applied and received renewals for their offerings.

As always, installers who find relevant training on their own can apply to the Board for credit.

The Maine Installer

State of Maine
BOARD OF UNDERGROUND STORAGE TANK INSTALLERS
17 State House Station
Augusta, Maine, 04333

Bulk Rate
U.S. Postage
PAID
Augusta, ME
04333
Permit No. 8

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